



# BuyIt Software Development Plan: A C-BASS Component

by Dana L. Ulery, Brian R. Schallhorn,  
and Wade S. Jernigan

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**ARL-MR-443****May 1999**

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## **BuyIt Software Development Plan: A C-BASS Component**

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## Abstract

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A critical factor in the U.S. Army Research Laboratory's (ARL) strategy to do more with less resources is the automation of a single, ARL-wide purchasing process. This report describes the initial plan for developing the BuyIt Prototype, a software prototype for an automated purchasing system that provides an electronic workflow for ARL purchasing processes and interfaces with standard Department of Defense (DOD) systems required by those processes. The BuyIt Prototype is the first component of the Corporate Business Application Software System (C-BASS), a suite of integrated online transaction process software products that will provide Corporate business functions electronically throughout the ARL enterprise. C-BASS is a cornerstone of the new ARL Enterprise Information Technology Architecture developed in 1997 by the Enterprise Systems Division. This report provides a statement of the problem to be solved by the BuyIt Software, the technical and management approaches to be used, and a detailed project schedule.

# Table of Contents

	<u>Page</u>
<b>1. Introduction .....</b>	<b>1</b>
1.1 Identification .....	1
1.2 Purpose .....	1
1.3 Background .....	1
1.4 Organizational Responsibilities .....	2
1.4.1 <i>Personnel Requirement</i> .....	2
1.4.2 <i>Interfacing Groups</i> .....	2
<b>2. Statement of Problem.....</b>	<b>3</b>
<b>3. Technical Approach .....</b>	<b>5</b>
3.1 Life-Cycle Strategy .....	5
3.2 Assumptions and Constraints.....	5
3.3 Anticipated and Unresolved Problems.....	5
3.4 Development Environment .....	5
3.5 Activities, Tools, and Products .....	7
<b>4. Management Approach .....</b>	<b>7</b>
4.1 Assumptions and Constraints.....	7
4.2 Resource Requirements.....	8
4.3 Milestones and Schedules .....	9
4.4 Metrics.....	9
4.5 Risk Management.....	9
<b>5. Product Assurance .....</b>	<b>10</b>
5.1 Assumptions and Constraints.....	10
5.2 Quality Assurance .....	10
5.3 Configuration Management.....	10
<b>6. References .....</b>	<b>11</b>
<b>Appendix: BuyIt Project Schedule .....</b>	<b>13</b>
<b>Distribution List .....</b>	<b>17</b>
<b>Report Documentation Page .....</b>	<b>19</b>

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## List of Tables

<u>Table</u>	<u>Page</u>
1. Project Personnel.....	3
2. Interfacing Groups.....	3
3. Prototype Assumptions .....	6
4. Prototype Constraints .....	6
5. Anticipated and Unresolved Problems .....	6
6. Major Activities, Methodologies, and Products.....	7
7. Distribution of Time Schedule and Effort Over Phases .....	8
8. Project Team Training Requirements .....	8
9. Key Project Metrics.....	9

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# 1. Introduction

**1.1 Identification.** This report covers the plan for the development of BuyIt for use at the U.S. Army Research Laboratory (ARL) Adelphi Laboratory Center (ALC). This plan defines work that was begun in January 1997. Planning charts and activities described in the plan refer to the actual dates on which these project events were expected to occur.

The BuyIt Prototype forms the nucleus of BuyIt Version 1.0 for use at ALC as a full production system. BuyIt is a component of the Corporate Business Application Software System (C-BASS) family of applications, an integrated family of Notes and Web-based software to support ARL electronic workflow and task automation. This suite of applications interfaces with standard DOD systems to provide functionality unique to research and development (R&D) competencies.

**1.2 Purpose.** The purpose of the BuyIt Prototype is to experimentally model a secure client/server system that will provide for the automated routing, approval, tracking, and reporting of small purchase requests as part of the ARL Intranet. The proof-of-concept prototype is useful to mitigate risks by resolving unknowns related to new technologies being used to build the ARL Intranet architecture and to refine user requirements described by the Business Process Reengineering (BPR) "To-Be Model" [1].

**1.3 Background.** Initiation of this work is motivated by ARL downsizing and findings of the ARL BPR report on the small purchase process. It is the first business computing application identified for implementation as part of the new ARL Intranet.

ALC has been identified as the site with the most critical need for automated small purchase capability because it has had major reductions in purchasing staff and currently has no automated purchasing tools. The BPR "To-Be Model: Small Purchase" [1] identifies potential process improvements, some of which require computer-aided automation to increase efficiency of purchasing operations in ARL.

The full BuyIt Application System will implement a secure ARL-wide client/server system that allows users to:

- (1) Request small purchases electronically,
- (2) Route the request to the necessary functional users for electronic approval,
- (3) Automate interfaces to necessary standard legacy systems, and
- (4) Provide tracking and reporting and travel request status.

BuyIt will conform to the Enterprise Systems Division (ESD) life-cycle strategy for ARL Intranet application development. Development will be performed in phases, using an incremental, evolutionary approach. The first deliverable will be the BuyIt Prototype described in this plan.

The prototype will provide end-to-end functionality with scaled-down capabilities and will be usable only at ALC.

**1.4 Organizational Responsibilities.** The ARL Corporate Information and Computing Center (CICC) ESD has the responsibility to develop the BuyIt plan and system for all ARL sites. The Acting Chief of ESD is Dr. Dana Ulery.

**1.4.1 Personnel Requirement.** The prototype project team requires personnel from ESD, the Computing Support Branch (CSB) of CICC's Automation Resources Division, the Chief of Staff (COS) Procurement Office, and an outside contractor. Table 1 lists the project personnel and their responsibilities.

**1.4.2 Interfacing Groups.** The BuyIt project requires interfacing to user groups and to the CICC Advisory Committee. BuyIt users include COS personnel in procurement, budget, and logistics as well as scientists, engineers, managers, and administrative personnel at ALC who purchase items in this category.

**Table 1. Project Personnel**

Name	Org.	%	Responsibility
Wade Jernigan	ESD	75	Coleader, Development, Documentation
Brian Schallhorn	ESD	75	Coleader, Development, Documentation
Janet David	ESD	60	Testing, Documentation, CM, Metrics
John Leopard	ESD	100	Development, Documentation
Wendy McCoy	ESD	100	Development, Testing
Sr. Notes Developer (Contractor)	ProVar	100	Development, Documentation
Pam Stuecklen	CSB	10	Lotus Notes System Administration
Debbie Baggett	COS	5	User Requirements

Timely responsiveness of interface groups is critical to meeting the schedule for this project. Interface groups and the roles they play relative to this project are listed in Table 2.

**Table 2. Interfacing Groups**

Group	Org.	Role
Business Analysts	COS	Budget, Logistics, and Procurement process and data requirements
Standard Operations and Maintenance Army Research Development System (SOMARDS) User	COS	SOMARDS interface
Standard Army Automated Contracting System (SAACONS) User	COS	SAACONS interface
CICC Advisory Committee	CICC, Director's office, COS, directorates	User requirements, business direction

## **2. Statement of Problem**

The prototype's key requirements are to provide the following automated functionalities:

- (1) Routing, approval, tracking, and reporting of small-purchase requests,
- (2) Funds certification through a SOMARDS interface, and
- (3) Upload of purchase request information into SAACONS.

Development of BuyIt Version 1 for full production use will be based on an evolutionary development approach that uses the Zachman architectural framework and an iterative, incremental life-cycle model [2, 3]. BuyIt Prototype Release 1 is the first intermediate product that will be developed on the path to developing BuyIt Version 1.

Four steps, each characterized by specific activities and the products produced by those activities, will be used to develop the prototype [4]:

- (1) Software requirements analysis,
- (2) Design analysis,
- (3) Implementation, and
- (4) System testing.

Deliverables will include:

- (1) Prototype software,
- (2) Prototype structured specifications document,
- (3) Prototype testing plans, and
- (4) Prototype user information sheet.

Intermediate software components produced to demonstrate specific functions will include:

- (1) Routing and tracking function,
- (2) Link to legacy systems, and
- (3) Reporting function.

The documents will provide precise, detailed technical models and processes, rather than ambiguous English-language descriptive text. They will be appropriately brief and, like the prototype software, form the nucleus for full system documentation [5].

### 3. Technical Approach

**3.1 Life-Cycle Strategy.** The life-cycle approach being used stresses three principles:

- (1) An architectural framework that explicitly defines critical system components from multiple perspectives and the relationships among these components in order to ensure integration of the business, operational, and computing models [6, 7];
- (2) Use of commercial-off-the-shelf products wherever possible to reduce costs and improve reliability and productivity [6, 7], and
- (3) Evolutionary, iterative steps to incrementally build multiple, shorter-cycle products and control risk [6, 7].

The prototype is the first phase in the life cycle of the full production product.

**3.2 Assumptions and Constraints.** Some of the key assumptions and constraints are shown in Tables 3 and 4, but the lists are not all-inclusive.

**3.3 Anticipated and Unresolved Problems.** Table 5 lists some of the anticipated and unresolved problems that could affect the prototype development and delivery.

**3.4 Development Environment.** The development environment will consist of:

- *Hardware*

- Server: PC, dual 133-MHz Pentium processors, 96 MB RAM, (2) 4.5-GB hard drives, 4X CD-ROM, 4-GB 4-mm tape drive, ethernet.
- Client development: PCs, Pentium.

**Table 3. Prototype Assumptions**

Assumption	Explanation
13 January 1997 - Project Start Date	Requires that the ALC Lotus Notes development server is installed, tested, and operational by that date. If not, start date must be delayed until these conditions are satisfied.
User requirements for prototype are frozen	Will be based primarily on the BPR "To-Be Model."
Prototype will not be used for critical operations	Prototypes are experimental models lacking the completeness and robustness of full production systems.

**Table 4. Prototype Constraints**

Constraint	Explanation
Incomplete user requirements analysis	Details of user requirements needed for software analysis will not be done for prototype.
ALC site only	Practices differ among sites, limiting complexity of business model.
Single product category	The requester may only purchase items that either (1) require no special approvals or (2) require special approval through only one designated office (TBD). This simplifies the automated special approval process.
Single vender per request	The requester may enter three suggested vendors, but they must be for all the items on the request. Separate items may not go to separate vendors. Simplifies the interface to SAACONS.
No requester credit card capability	All requests must go through the full procurement cycle. Procurement buyers may use credit cards.

**Table 5. Anticipated and Unresolved Problems**

Problem	Details
Skill gaps	Project developers from ESD have very limited Lotus Notes experience and few software engineering skills. Personnel from Systems Operations Branch (SOB) have very limited experience administering Lotus Notes.
Hardware	<ul style="list-style-type: none"> <li>• New Lotus Notes servers not fully tested in ARL development environment.</li> <li>• New development client hardware required for this project not yet tested in ARL development environment.</li> </ul>
Legacy systems	<ul style="list-style-type: none"> <li>• Need for middleware products between Notes and the legacy systems (SOMARDS and SAACONS) not yet resolved.</li> <li>• SOMARDS function is moving to Rock Island, IL, severely restricting ARL access to SOMARDS systems personnel necessary to support any special input/output (I/O) or interface needs.</li> </ul>

- *Software*

- Server: Microsoft Windows NT Server v4.0 w/Lotus Notes Server v4.5.
- Client development: Microsoft Windows 95 or NT Workstation v4.0 w/Lotus Notes Desktop v4.5.
- Middleware between Lotus Notes and the legacy system (TBD).

**3.5 Activities, Tools, and Products.** Table 6 lists the major activities, methodologies, and tools to be used and the products of each phase during the prototype development cycle.

**Table 6. Major Activities, Methodologies, and Products**

Activity	Methodology/Tools	Products
Software Requirements Analysis	Structured analysis [4]	<ul style="list-style-type: none"> <li>• Data flow model</li> <li>• Data model</li> <li>• Structured specifications document</li> </ul>
Design Analysis	Structured design [8, 5]	<ul style="list-style-type: none"> <li>• Legacy interfaces</li> <li>• Forms design</li> <li>• Navigators design</li> <li>• Structure charts</li> </ul>
Implementation	Lotus Notes application development [9]	<ul style="list-style-type: none"> <li>• Routing and tracking function</li> <li>• Link to legacy systems</li> <li>• Reporting function</li> <li>• Prototype software</li> </ul>
System Testing	<ul style="list-style-type: none"> <li>• Software engineering testing methods and tools</li> <li>• Configuration management</li> </ul>	<ul style="list-style-type: none"> <li>• Prototype test plan</li> <li>• Inspection summaries</li> <li>• Test logs</li> <li>• Discrepancy reports</li> <li>• Configuration management controls</li> </ul>

## 4. Management Approach

**4.1 Assumptions and Constraints.** Lack of experience with Lotus Notes application development and the new C-BASS computing environment combine to maximize the software engineering complexity rating for this project. The less than 2 years of experience, on average,

with the project technologies increases the uncertainty of effort estimate by a factor greater than 2.

This circumstance also is reflected in the projected schedule of activities and milestones. For example, training will have a high priority during the initial stages of the project.

Factors of resource scheduling also impact the development timeline given in this report. While the BuyIt Prototype has a high priority for ESD, it must compete with other high-priority tasks associated with establishing the ARL Intranet. Three project personnel from ESD, including both coleaders, are responsible for and are working on other assignments in parallel with their work on this project.

**4.2 Resource Requirements.** Estimates of the distribution of time schedule and effort over the development phases are listed in Table 7. Estimates of formal training requirements for project team members are shown in Table 8.

**Table 7. Distribution of Time Schedule and Effort Over Phases**

Phase	Time Schedule (%)	Effort (%)
Software Requirements Analysis	15	12
Design Analysis	25	33
Implementation	45	40
System Testing	15	15

**Table 8. Project Team Training Requirements**

Course	Time Schedule (%)	Total (Weeks)
Lotus Notes Application Dev. II	5	3
Advanced Lotus Notes	3	1.5



**4.3 Milestones and Schedules.** Appendix A gives the detailed schedule for this project, showing work breakdowns, task duration, start and end dates, task dependencies, and milestones (based on the received guidance for the project start). Significant milestones include:

- Installing the hardware and software making up the development environment,
- Completing software requirements analysis,
- Defining system architecture, data description, user interface, and processing actions,
- Implementing software designs and link to legacy system, and
- Bench-testing and field-testing the prototype.

**4.4 Metrics.** Metrics will be used to monitor and manage progress and product quality. Both objective and subjective data will be used to get a picture of project status. Key project metrics and their uses are listed in Table 9.

**Table 9. Key Project Metrics**

Metric	Frequency	Use
Development task status	Weekly	Progress, process control, design stability
Changes (to specs, design)	Biweekly	Quality of specs, design; identify need to iterate an earlier phase
Software size estimates	Biweekly	Progress; quality of process and design
Tests	Weekly	Progress; quality of software, design

**4.5 Risk Management.** The primary tool for managing risk is the use of disciplined software engineering approaches and methods [6, 7]. As mentioned elsewhere in this plan, the use of multiple new technologies coupled with an inexperienced staff makes this a project subject to risk. The detailed technical models being developed in all phases of the project provide a basis for assessing technical risk. Potentially high-risk conditions, whether technical or nontechnical, will be identified promptly and brought to the attention of the managers responsible for decisions regarding project resources and timing.

## 5. Product Assurance

**5.1 Assumptions and Constraints.** The BuyIt Prototype is a proof-of-concept model and is not intended for use in a production environment or as a tool to replace a critical manual system.

**5.2 Quality Assurance.** Monthly 2-hour reviews will be held at ALC with management from CICC, COS, and the CICC Advisory Committee to assess the condition of the project. The reviews will provide regularly scheduled monitoring of project status. They will address quality assurance by examining the plans, milestones, and intermediate products associated with the development process.

The first review is scheduled for the morning of 4 February 1997, subject to the 13 January starting date.

**5.3 Configuration Management.** Standard Configuration Management (CM) methodology will be used to control changes to system products. The following list gives the prototype products that will be under CM control:

- (1) Product Software,
- (2) Software Development Plan,
- (3) Software Requirements Analysis Document,
- (4) Data Flow Model,
- (5) Data Model,
- (6) Design Document,
- (7) Test Plan, and
- (8) Test Reports.

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**Appendix:**  
**BuyIt Project Schedule**

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ID	Task Name	Duration	Start	Finish	January							February							March							April			
					1/5	1/12	1/19	1/26	2/2	2/9	2/16	2/23	3/2	3/9	3/16	3/23	3/30	4/6	4/13										
1	Development Environment	5d	1/15/97	1/22/97																									
2	Lotus server (HW & SW) installed	1d	1/17/97	1/17/97																									
3	Lotus access control implemented	1d	1/21/97	1/21/97																									
4	PC hardware installed	2d	1/15/97	1/16/97																									
5	Lotus clients installed	1d	1/22/97	1/22/97																									
6	Software Requirements Analysis	10d	1/13/97	1/27/97																									
7	Freeze user requirements	1d	1/13/97	1/13/97																									
8	Develop data flow model	5d	1/14/97	1/21/97																									
9	Develop Data Model	5d	1/14/97	1/21/97																									
10	Prepare software req. analysis document	4d	1/22/97	1/27/97																									
11	SRA Document - Release 1.0	0d	1/27/97	1/27/97																									
12	Design Analysis	17d	1/27/97	2/19/97																									
13	Define system architecture	11d	1/28/97	2/11/97																									
14	Define legacy interfaces - data description	15d	1/27/97	2/14/97																									
15	Define screens	11d	1/27/97	2/10/97																									
16	Define reports	5d	2/10/97	2/14/97																									
17	Define processing actions	15d	1/27/97	2/14/97																									
18	Define structure charts	3d	2/12/97	2/14/97																									
19	Prepare design document	7d	2/10/97	2/19/97																									
20	Design Document - Rel 1.0	0d	2/19/97	2/19/97																									
21	Implementation	30d	2/20/97	4/2/97																									
22	Develop routing and tracking function	9d	2/20/97	3/4/97																									

Project: Buyit

Task

Progress

Milestone

Summary

Rolled Up Task

Rolled Up Milestone

Rolled Up Progress

ID	Task Name	Duration	Start	Finish	January														February							March							April																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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13. ABSTRACT (Maximum 200 words) <p>A critical factor in the U.S. Army Research Laboratory's (ARL) strategy to do more with less resources is the automation of a single, ARL-wide purchasing process. This report describes the initial plan for developing the BuyIt Prototype, a software prototype for an automated purchasing system that provides an electronic workflow for ARL purchasing processes and interfaces with standard Department of Defense (DOD) systems required by those processes. The BuyIt Prototype is the first component of the Corporate Business Application Software System (C-BASS), a suite of integrated online transaction process software products that will provide Corporate business functions electronically throughout the ARL enterprise. C-BASS is a cornerstone of the new ARL Enterprise Information Technology Architecture developed in 1997 by the Enterprise Systems Division. This report provides a statement of the problem to be solved by the BuyIt Software, the technical and management approaches to be used, and a detailed project schedule.</p>				
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